R & D facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Gas Energy Systems Dynamics

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Fuel Cell Development and Evaluation Test Stand

Capabilities

Fuel cell generated electricity has emerged as a potential option for a wide range of power applications. To support this technology, National Energy Technology Laboratory's Fuel Cell Test and Evaluation Project is evaluating fuel cells ranging between 20 to 5000 Watts. The test stand currently employs gaseous hydrogen and air for the reactants. In the future, reformer technology will also be employed. Cooling water is available for fuel cell designs that require additional thermal management. Independent humidification control of the air and fuel streams, which may be important in the operation and testing of PEM (Proton Exchange Membrane) fuel cells, is available through the use of specially-designed, electrically heated, pressure vessels. To dissipate the electric power from the fuel cell, a variety of air-cooled "load-banks" are employed.

Testing and evaluation of a fuel cell includes running the system under its expected load cycles and acquiring voltage and current information, as well as ensuring that mass and energy are continuously balanced during operation. Stack impedance measurements can also be studied. From this data, reliability assessments can be made. As examples of the type of load cycles studied, periodic (several times a day) start-up and shutdown sequences are examined to replicate battery recharging applications. Finally, steady (over 8 to 10 hours) 5kW or less power tests may be studied to replicate remote expendable instrument applications.

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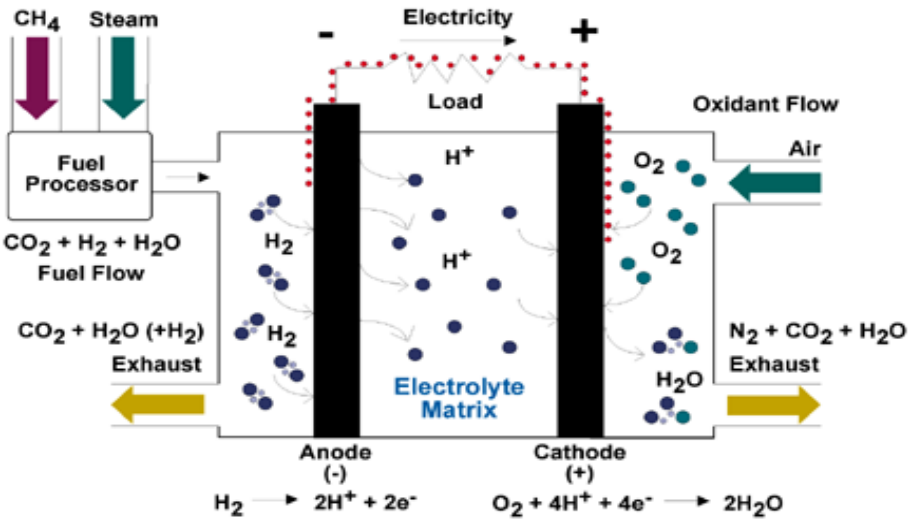
Fuel Cell Evaluation Test and Stand

Example Fuel Cell (PEM) Operation

Hydrogen is ionized at the anode surface of the fuel cell and transported as an H+ ion through the electrolyte. It is oxidized at the cathode surface with oxygen atoms created from the air supply. The oxidized product is simply water and water vapor, which is removed from the cathode surface by convection.

Opportunities

Presently this project is supporting NETL's goal to advance fuel cell performance through the development of improved flow and energy management technology. This will be accomplished through the application of MEMS flow devices in fuel cells. These devices will allow increased lifetime and wider range of operation. Our long range goal is to form joint government-industry-academia partnerships to solve energy and environmental problems using fuel cell power systems that will have application to stationary, mobile, and specialty military applications.



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